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Review article

Evaluation of older Adults with obesity for bariatric surgery: Geriatricians' perspective

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ABSTRACT

The prevalence of obesity in the general population is increasing worldwide, and those surviving are at an increased risk for developing comorbidity and physical limitations. With aging, obesity places this high-risk population at an increased risk for future morbidity, institutionalization, and functional decline. Traditional weight loss programs lead to inconsistent improvements in comorbidity, function, and quality of life. Bariatric surgery may offer a reasonable alternative in selected patients to achieve improvements in these outcomes. We present our approach in assessing the physiologic age of older candidates for bariatric surgery from a geriatrician's perspective that may be useful for general internists, bariatricians, and general surgeons alike. We present how a focus on function and physiological parameters of aging provides more predictive power than that on chronological age alone.

1. Introduction

Improved life expectancy has allowed the aging population[1] (Fig. 1) of baby boomers to enter their "golden years" in unprecedented numbers. Rises in obesity prevalence, measured by body mass index (BMI), parallel this aging demographic, with rates of obesity climbing from 12.3% and 16.5% in males and females, respectively, in the >60-year age group in 1976–1980 to 36.6% and 42.3%, respectively, in 2009–2010 (Fig. 2).[2,3] This population is at risk of developing cancer, heart disease, diabetes, lower extremity arthritis, sleep apnea, and stroke,[4] all of which lead to disability.[5,6] A "U-shaped" curve between BMI and mortality flattens with age.[2] In fact, older people with a BMI of 25–30 kg/m^2 may have the lowest risk of death, while those with a BMI of >30 kg/m^2 may be at higher mortality risks,[7] with the majority of deaths attributable to cardiovascular disease.[8] This epidemic of obesity is countering the gained improvement in primary and secondary prevention efforts of cardiovascular disease.[9] Longitudinal studies have proved that certain subgroups of overweight elderly persons may have a survival advantage due to genetic influences, whereas others have succumbed to obesity-related complications.[10] Recent evidence suggests that high muscle mass and quality may be protective as well.[11]

2. Risks and benefits of intentional weight loss in older adults

Obesity-related comorbidity can be reversed even with a modest 5–10% weight loss.[12,13] Obesity was found to be associated with a 60% higher risk of functional decline in one review.[11] Obesity duration impacts disability, with those classified as obese throughout the lifespan having a 2.38 times higher risk than those who are not.[14] Weight gain can lead to an increased risk of nursing home placement.[15] Major trials have examined the effectiveness of intensive lifestyle modifications involving weight reduction in demonstrating improvements in cardiovascular risk factors.[12,13] The Arthritis, Diet, and Activity Promotion Trial[16] demonstrated that diet and exercise led to improved metabolic equivalents and reduced all-cause mortality in older adults with osteoarthritis. Villareal et al[17] reported reversibility of frailty in older adults losing weight with a combination of diet and exercise, leading to improvements in metabolic factors and functional outcomes (including short performance physical battery and gait speed) and lesser reductions in muscle mass with loss of weight. This pivotal

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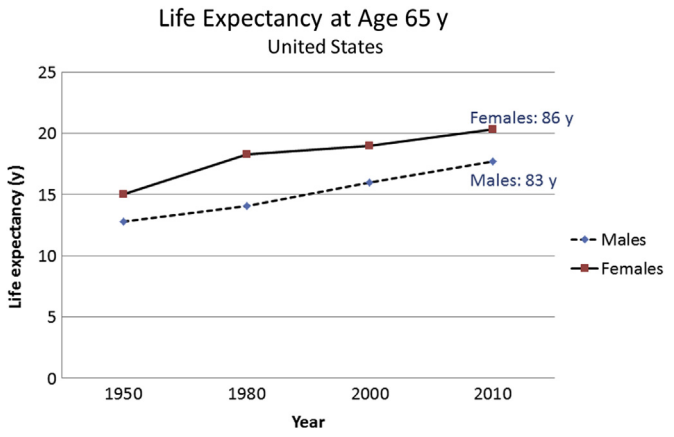

Fig. 1. Life expectancy after the age of 65 years. Data from the United States Census Bureau demonstrating life expectancy in males and females at the age of 65 years at different time periods.[1]

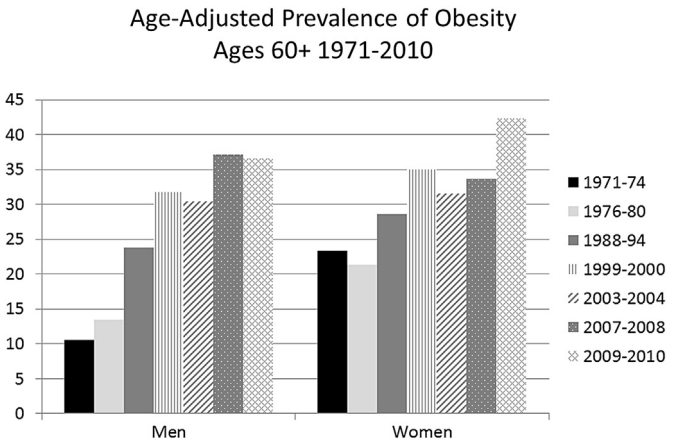

Fig. 2. Age-adjusted prevalence of obesity in older adults. Sex-specific data from the National Health and Nutrition Examination Surveys in the past 4 decades demonstrating the increasing prevalence in obesity among both sexes, as measured by body mass index in older adult population.[2,3,123]

randomized trial demonstrated that when weight loss was indicated, exercise training may play an even more important role than dietary management alone, even in older adults at risk for decline. Recently, the European Society for the Study for Obesity has published guidelines for managing older adults with obesity.[18] The Obesity Society recently updated guidelines for the general adult population,[19] but specific guidelines for seniors were last published in 2005.[20] Importantly, most trials have failed to adequately examine the risks of weight loss on bone and muscle quality and mass.

3. Nonsurgical weight loss strategies

Clinicians are ill equipped to provide lifestyle recommendations in primary care,[21] a problem heightened in an elderly population where conflicting reports suggest that weight loss may be associated with underlying diseases or mortality.[22] Recently, the Centers for Medicare and Medicaid Services have approved the coverage of obesity management for Medicare beneficiaries, providing support for intensive dietary and behavioral therapy. Yet, implementation into clinical practice is difficult, challenges of which are outside the scope of this review.[23] Whether weight loss should be considered a primary outcome measure in older adults also requires further investigation. Goals are to maintain a healthy weight and minimize the risk of incident disability. Behavioral strategies effectively produce significant weight loss without significant risk to patients.[24] Pharmacological therapy often is not advocated in older adults due to the lack of safety and efficacy data, exclusion of elderly people from clinical trials, and polypharmacy existing in this population.[25] While endoscopic devices are of unproven efficacy and are potentially promising in facilitating long-term weight loss, they are currently awaiting approval in the United States.

4. Bariatric surgery

Bariatric surgery (BSx) is approved in individuals with class II–III obesity, who otherwise have been unsuccessful in implementing lifestyle modifications to sustain weight loss. Some studies have examined both short- and long-term outcome measures, including cardiovascular risk[26] and overall mortality,[27] in the general population. Based on these studies, there is a consensus that surgery should be considered in patients <50 years old, although the upper limit has since been adjusted. The position paper by the European Society for the Study of Obesity outlines that selected elderly people should also be considered for surgery, eliminating the upper age limit.[18] The overall primary surgical goal should be to slow the functional decline trajectory.

4.1. Short-term outcomes (<1 year)

The efficacy of short-term metabolic outcomes in older adults is well established. Weight loss is feasible and effective in improving comorbidities such as diabetes, hypertension, and obstructive sleep apnea.[28,29] Quality of life improved, as reflected by the 22-point improvement on the Short-Form 36, compared to age-matched norms,[30] in a large study of 113 patients aged >60 years. No guidelines exist to recommend a certain type of surgery in older adults. A lack of data exists that directly compares the different weight loss procedures. Roux-en-y gastric bypass led to 59.8% reduction in weight, compared with adjustable gastric band or vertical sleeve gastrectomy (33.5%, and 34.3% weight reduction, respectively) no differences in quality of life among the different procedures[31] and no differences from younger patients.[32] This contrasts with the results of Sugerman et al.[33] Biliopancreatic bypass in older adults is less favored due to a higher rate of complications in them.[34] Much has been published in abstract form and not peer-reviewed. For instance, laparoscopic roux-en-y gastric bypass is associated with 60.3% excess weight loss, compared to sleeve gastrectomy or banding, and complications were observed in only 16% of people.[35] Others have observed similar findings with no differences in complications.[36] Studies are needed to guide the appropriate surgical procedure in older adults.

Hard endpoints, including 30-day morbidity and mortality, are used as surrogates for outcome success, which have demonstrated conflicting outcomes in BSx in older patients and focus primarily on short-term hospital-based outcomes and mortality. Elderly people are often classified according to age (people aged >55 years and those aged >60 years). None evaluates the physiological age that has profound implications on overall functional status, medication burden, and comorbid medical and geriatric syndromes. One study in older Medicare beneficiaries from 1997 to 2002 showed a higher rate of death at 30 days (4.8% vs. 1.7%), 90 days (6.9% vs. 2.3%), and 1 year (11.1% vs. 3.9%) compared to younger patients.[37] Older beneficiaries >75 years of age had a higher 90-day risk of death compared to those aged 65–74 years. This study had a number of limitations. First, it combined various types of bariatric procedures that otherwise are not performed currently. Second, the data were limited to a time period when medical/surgical care has

significantly improved, with emphasis on both perioperative care and outcomes. Bariatric care has markedly evolved due to an increase in the volume of bariatric surgery, formal training programs, and specialized, multidisciplinary tertiary care BSx centers of excellence. Fourth, this cohort excluded laparoscopic procedures due to potential errors in cohort identification. The number of laparoscopic procedures has increased considerably, a procedure having fewer complications in the elderly.[38] A more recent study demonstrated that the length of stay and adverse outcomes in Medicare beneficiaries after BSx in individuals aged 18–59 years were not different from those aged 60–66 years.[39] Livingston and Langert[40] used a national sample of hospitalized patients in the USA from 2001 and 2002 and observed that adverse outcomes increased with age and disease burden. While older adults have higher degrees of comorbidity and perioperative risk, they stand to gain the most from the surgery. In carefully selected patients, age should not preclude surgical intervention.[41] The paucity of data and conflicting reports suggest a need to identify the appropriate surgical candidate (outside of eligibility from a medical comorbidity and psychosocial standpoint) aside from using age as a strict criteria. Identification of studies that examined physiological age in patients >60 years of age is urgently needed, as none have been published in a manuscript form.

4.2. Longer-term outcomes (>1 year)

Long-term effects of BSx and other weight loss interventions are only partially understood. With aging, overall goals and preferences change. Quality of life diminishes with age[42] and is further exacerbated with coexistent obesity. Disability and functional limitations, independent of BMI, rise with age,[11] augmenting the risk of institutionalization.[15] Longevity itself is often a lesser priority—"quality over quantity" often emerges as a principle and concept in routine geriatric decision-making. Our opinion is that older people need to balance the risks and benefits of any procedure, but in the context of elective procedures such as BSx, the potential benefits on quality of life and functional status need to be materialized over the course of their remaining lifetime.

Cornerstones of osteoarthritis management in obesity include weight loss and physical activity. In younger patients, even a mild degree of weight loss leads to improved range of motion, decreased pain, and reduction in disability.[43] The evidence in older adults suggests the same directional improvements as observed in younger population.[44] The Arthritis, Diet, and Activity Promotion Trial was pivotal in proving that weight loss in older adults with knee osteoarthritis lead to improvements in functional status.[16] Weight reduction accomplished by BSx reduces joint pain,[45] improves musculoskeletal conditions[46] and arthropathy, and leads to a 66% reduction in arthritis-specific medications in the elderly.[47] Morbidly obese patients unsuitable for arthroplasty because of excess weight and comorbidity should be considered for BSx first, followed by total joint arthroplasty.[48] While further research is needed in older adults, BSx may be one potential management approach to reduce the risk of long-term placement.

Sarcopenia, defined as the loss of skeletal muscle mass and strength occurring with aging,[49] may have profound implications in older adults seeking BSx due to the marked alterations of body composition. Its definition, measurement, and characterization are debated,[50] but it progresses with age and is associated with physical disability, reduced quality of life, and death.[51,52] Changes in lean body mass ranges from 10% to 25%, and are often negatively correlated with weight loss.[53,54] Such alterations in fat-free mass may impact disability, function, and frailty. The importance of modulating the loss of fat-free mass with fat-mass may reflect sarcopenia or malnutrition, which can partially be mitigated with resistance exercises.[55] The loss of subcutaneous fat and lean mass in patients undergoing BSx has been discussed; this loss occurs in varying degrees.[56] Decreases in muscle mass impairs the usual improvement in insulin sensitivity induced by BSx-induced fat loss.[57] Although obese people have an increased degree of muscle mass, research should concentrate on mitigating loss of muscle mass and strength following BSx. Lastly, while metabolic parameters improve, malabsorptive procedures (biliointestinal bypass) may have more favorable effects on body composition.[58] Potential identification of individuals at risk of fulfilling criteria of sarcopenia[59] may be needed preoperatively.

Bone loss is a part of normal aging peaking in the 3rd and 4th decades, and dropping in older adults.[60] A 10% weight loss leads to a 1–2% decline in bone loss.[61] Reduction in weight bearing, vitamin D, and calcium deficiencies occurring with Roux-en-Y Gastric Bypass (RYGB) are important contributors.[62] Early increases in bone remodeling can occur as early as 3 months postsurgery despite consumption of supplements.[63] This phenomenon persists up to 18 months, leading to increased bone fragility and impaired cross-linking. While exercise programs can mitigate this effect considerably,[64] a risk–benefit analysis in patients is needed to ascertain possible risks of future fractures as well. An increased fracture risk is likely in the long term as well.[65]

Recent reports have noted the postsurgical effects on cognition. Cognitive test performance improves up to 36 months postsurgery, with marked improvements in those exhibiting extended postoperative weight loss[66] and those with lower follow-up BMI.[67] Future studies performing full neuropsychiatric assessments and/or neuroimaging with biomarkers may assist in elucidating underlying mechanisms of improvement.

5. Comprehensive geriatric preoperative assessment

We incorporate into our decision-making the physiological changes occurring with age, all of which increase the complexity of perioperative care. The American College of Cardiology/American Heart Association (ACC/AHA) guidelines for preoperative cardiovascular assessment focus on intrinsic patient factors, exercise capacity, and surgery-specific risks[68] within a comprehensive history and physical examination. Reduction in perioperative mortality[69] following such assessment has been demonstrated. Problems such as cardiopulmonary or renal issues, and elderly-specific concerns, including the presence of frailty, polypharmacy, and cognitive issues, require a review. Pulmonary evaluation focuses on identifiable and preventable complications including atelectasis, pneumonia, and pulmonary embolism, which account for the majority of postoperative mortality and morbidity, in addition to sleep apnea evaluation. Preoperative testing includes a complete blood count, blood urea nitrogen, serum creatinine with glomerular filtration rate, electrolytes, liver function tests, possibly coagulation studies (prothrombin time/activated partial thromboplastin time), serum albumin, and electrocardiogram. Conventional predictive tools predict 30- and 90-day operative outcomes,[70] but perform poorly in predicting 90-day survival of elderly patients.[70] Older surgical patients (>80 years) automatically fall into the high-risk category of American Society of Anesthesia classifications, leading to inadequate discrimination between patients with different homeostatic capacities and results.[71]

"Prehabilitation" attempts to maximize preoperative function and nutrition, and reduce frailty. It is physiologically logical to consider it as a means of reducing postoperative complications. Prehabilitation measures include smoking cessation prior to surgery, maximization of pulmonary function via bronchodilators/controlling medications, and consideration of preoperative

Table 1
Functional status—activities of daily living.[120,121]

Basic	Instrumental
Bathing	Shopping
Dressing	Housekeeping
Transferring from bed to chair	Preparing meals
Toileting	Taking medications
Eating	Finances
Walking	Using transportation
	Making phone calls

inspiratory muscle training programs for selected patients, although evidence supporting these measures is lacking. Specific cardiopulmonary surgery and BSx algorithms[72] have been reviewed elsewhere and would apply equally to older adults. Inspiratory muscle training programs can reduce postoperative pulmonary complications in patients undergoing coronary artery bypass grafting.[73] Preoperative knee exercises have been proved to be valuable in some studies for rapid restoration of postoperative function.[74] Implementation of an exercise program, protein supplementation, and anxiety reduction resulted in a faster return to baseline function in patients undergoing colorectal surgery.[75] A recent review indicated the benefits of total-body prehabilitation on pain, physical function, and length of stay.[76] A key geriatric-specific goal of elective surgery is maintenance or improvement of the previous level of function, as hospitalization itself poses risk of loss of function.[77] The ability to ascertain baseline function should come not only from patients, who under-report disability,[78] but also from caregivers, families, and community-based ancillary staff, who can provide a clearer picture of preoperative level of function. Functional capacity can be assessed by identifying basic and instrumental activities of daily living (ADL; Table 1). Roughly 15% of elderly people maintain a loss of one basic ADL following hospitalization, and 20% do not fully recover prehospitalization abilities.[79] However, the age-related increase in surgical complications is tightly related to underlying comorbidities and functional capacity rather than to age, and healthy elderly patients have surgical complication rates comparable with those of healthy younger patients.[80] Compared to individuals free of basic ADL impairments, those with six impairments had a 13-fold higher risk of in-hospital mortality, four-fold risk of 1-year mortality, and ~15-fold risk of nursing home stay, and the associated costs were higher.[81] Our interprofessional team advocates an approach focusing on function and aging physiology rather than on chronological age. Best practice guidelines for geriatric surgical patients exist.[82] Understanding patients' surgical expectations, and the postoperative course and recovery are equally important in ensuring candidacy, but particularly important in evaluating BSx patients.

5.1. Assessment of frailty

A frailty assessment should be incorporated in older adults who are candidates for BSx. Predictive "bioassays" for a senior patient's particular physiological resilience are being validated in the assessment of older surgical patients.[83] Frailty markers can improve postoperative risk prediction.[84] Robinson et al[85] identified patients scheduled for major elective procedures, and found that higher degrees of frailty were related to increased rates of institutionalization and 30-day readmission. Others demonstrated increased length of stay or discharge to skilled nursing facility using frailty as a marker.[83]

While a number of different frailty instruments are available, we favor the Fried frailty criteria, (Table 2)[86] due to the ease of incorporating these measures in routine practice. A low walking speed (<1.0 m/s) predicts death[87] and can be assessed using the time to walk 4 m. These criteria have not been evaluated in a BSx population, but in a cardiac surgery population, gait speed was associated with a three-fold risk of major complications or death and a two-fold risk of discharge to a nursing home among cohorts with otherwise equal preoperative Society of Thoracic Surgeons risk scores.[88] Grip strength as a frailty marker adds further predictive validity in an obese older population.[89] Preserved grip strength may predict functional recovery,[90] may reduce postoperative outcomes, and is a marker of nutritional state.[89] One study demonstrated a strong correlation with postoperative body composition changes but no changes in static muscle force,[56] although evidence suggests that muscle strengthening programs in obese people lead to improvements in strength.[91]

5.2. Depression

The general prevalence of depression among community-dwelling Americans aged ≥71 years a ranges from 9% to 12%[92]; however, the prevalence of major depressive disorder in candidates for BSx is considerably higher.[93] de Zwaan et al[94] found that one-third of their candidates met the criteria for current depressive disorder and that up to 50% had active "depressive disorders" to some degree. No prevalence data of depression in older adults seeking BSx exist, but one might extrapolate similar trends exhibited for the older population. Depression after surgery in older adults has been described in other populations,[95] including a general surgery population, suggesting that one would expect similar trends in older adults undergoing BSx. Pre-existing depression has been associated with a lowered threshold for pain perception and increased postoperative opioid use,[96] both of which may impair rehabilitation[97] and increase one's risk of delirium.[98] The presence of depression is an independent risk factor for postoperative delirium, with some studies estimating a

Table 2
Characteristics and clinical correlates of the frailty phenomenon.[86]

Characteristics of frailty[a]	Clinical measure
Shrinking—unintentional weight loss or sarcopenia	>10 pounds lost unintentionally in the past year
Weakness	Grip strength in the lowest 20% at baseline, adjusted for gender + body mass index
Poor endurance or exhaustion	Self-reported exhaustion identified by 2 questions from the Centers for Epidemiology Studies Depression (CES-D) scale "How often in the last week did you feel this way" 0—rarely; 1—1–2 d; 2—3–4 d; 3—most of the time 1. I felt that everything I did was an effort 2. I could not get going
Slowness	Time to walk 15 feet, adjusting for gender and standing height
Low activity	Lowest quintile of physical activity identified for each gender (based on the short version of the Minnesota Leisure Time Activity Questionnaire)

[a] Frail: ≥3 criteria present; prefrail: one or two criteria present.

doubling of incidence with pre-existing depression.[99] This "overlap syndrome" of depression and delirium is associated with significant risks of functional decline, institutionalization, and death in hospitalized general medical patients.[100] Preoperative psychological assessment should always be a routine component in the multidisciplinary evaluation of bariatric surgical candidates[101] irrespective of age.

First-line antidepressants, including selective serotonin reuptake inhibitors or selective serotonin/norepinephrine inhibitors, need not be discontinued preoperatively, given their safety with anesthetics. There is evidence of increased hemorrhage, which may be a surgical factor, especially when combined with antiplatelet therapy.[102] We recommend that other agents with an antiplatelet effect (low-dose aspirin and thienopyridines) are best stopped preoperatively if allowable from a cardiac perspective. Abrupt discontinuation of selective serotonin reuptake inhibitors (SSRIs) may lead to a "discontinuation syndrome," particularly in those who are unable to tolerate oral intake postoperatively. Drug interaction of SSRIs with tramadol may precipitate the serotonin syndrome, and dosing of citalopram at ≥40 mg in older adults should be reassessed preoperatively for safety, given its potential for QT prolongation.

There is evidence for the influence of psychosocial factors, including depressed mood, on clinical outcome postsurgery. One meta-analysis demonstrated that attitude and mood strongly predicted the speed and extent of recovery from surgery.[103] Psychological factors were also observed to affect outcomes of wound healing, infection, and mobilization.[104]

5.3. Cognitive assessment

The prevalence of overt dementia in community-dwelling adults is 1% at age 60 years, 14% by age 70 years, and 37% after age 90 years.[105] Dementia is often successfully masked by patients, and may affect the capacity of patients to understand and participate in decision-making.[106] Simple office-based cognitive screening tools, coupled with an accurate history from a family member or caregiver, often make a preoperative diagnosis of cognitive impairment easy. Cognitive impairment is the most potent risk factor for postoperative delirium, increasing the risk up to fivefold.[107] Delirium independently increases length of stay, inpatient complications, and mortality, leading to long-term functional decline.[108] Discontinuation of high-risk medications, optimization of hydration and oxygenation postoperatively,[109] and implementation of evidenced-based delirium prevention protocols can reduce delirium during hospitalization and postoperatively by 30–50% (Table 3).

No data exist in the BSx literature regarding the prevalent rates of cognitive impairment in those eligible for surgery. However, attentional/executive function testing and verbal/memory testing in one study predicted a likelihood of 24-month weight loss success.[67] With the intensive dietary management required post-BSx, cognitively impaired individuals may have an inability to process, execute, and follow strict instructions, reducing the enthusiasm for a surgical team to intervene.

Table 3
Delirium prevention protocols.[122]

Adequate oxygenation & hydration	Adequate sleep with nonpharmacological measures
Adequate pain control	Avoiding overnight vital signs
Cognitive stimulation & reorientation	Music/massage
Family & staff	Maximizing sensorium
	Use of hearing aids & glasses

5.4. Social support/discharge planning

Patients with an inadequate home situation or social supports are at higher risk postoperatively, and assessment for additional home care needs and/or skilled rehabilitation for restoration of function is clearly needed. Achievement of safe mobilization, postoperative respiratory recovery, proper medication adherence, and wound care are all dependent on the capacities of caregivers as well. Poor social support for older obese patients requiring ongoing behavioral management increases the likelihood for failure post-surgery,[110] independent of the postoperative surgical needs. The degree of social support and caregiving predicts outcomes.

6. Other geriatric-specific preoperative considerations

6.1. Advanced care planning

Surgeons often do not discuss advanced directives with patients, except for postoperative life-supporting therapy during informed consent[111] even then the expectation that this is discussed falls on patient rather than provider.[112] Often, advanced directives have not been contemplated even in frail patients undergoing life-threatening procedures.[113] Based on older data, Joint Commission requirements mandate the discussion of advanced directives. We suspect that such discussions are now being performed more frequently. While the legalities vary from state to state, an emerging Physician Orders for Life Sustaining Treatment Paradigm program is being considered, which includes topics regarding resuscitation status, need for medical care, nutrition and hydration, ventilation, and dialysis, in the context of permanent incapacity.[114] These issues are best explored preoperatively in the primary care setting among family members, potential caregivers, and clinicians who have maintained longitudinal relationships with the patient.

6.2. Genitourinary system

The glomerular filtration rate declines with advancing age, and its estimation in older patients can be problematic, as this marker declines nonlinearly with age. Standardized equations may be helpful in adjusting renally excreted medications, but their validity is based on younger, community-dwelling populations, possibly limiting their application to older adults and leading to over/underestimation of the glomerular filtration rate. However, they may be helpful in guiding perioperative medication dose adjustments to prevent adverse drug events and common iatrogenic complications. Renal dysfunction has profound implications on insults that may occur intraoperatively, but importantly, certain types of medications, which would often be utilized in younger populations (i.e., nonsteroidal anti-inflammatories), would be recommended only with caution and in short periods of time in the elderly population. Dose adjustment of medications is needed perioperatively to prevent adverse drug events and common iatrogenic complications.

Underlying benign prostatic hypertrophy and risk for urinary retention in the older male patients are common, and elderly men are at a high risk for acute urinary retention post elective surgery. Those at risk should have discussions about preoperative interventions with finasteride or alpha blockers that may lessen acute retention.[115] Baseline American Urological Association scoring can be used as a part of the preoperative assessment.

6.3. Polypharmacy and iatrogenic complications

The American Geriatrics Society has sponsored an update of the Beer's criteria highlighting medications that are potentially

Table 4
Potentially inappropriate medications for older adults.[98]

Class	Common examples	Recommendation	Rationale
Anticholinergics	Diphenhydramine Hydroxyzine Promethazine	Avoid	Anticholinergic Confusion
Antispasmodics	Belladona alkaloids Dicyclomine Hyoascyamine Scopolamine	Avoid except in palliative care	Anticholinergic
Antithrombotics	Dipyridamole (alone)	Avoid	Orthostatic hypotension
Anti-infective	Nitrofurantoin	Avoid	Pulmonary toxicity
Cardiovascular			
α-Blockers	Doxazocin Prazosin Terazosin	Avoid use as an antihypertensive	Orthostatic hypotension
Central α-blockers	Clonidine	Avoid	Adverse CNS effects Bradycardia Orthostatic hypotension
CNS	Amitryptilline Doxepin Imipramine	Avoid	Anticholinergic Orthostatic hypotension
Antipsychotics	All medications	Avoid unless nonpharmacological methods for behavioral problems of dementia fail	Risk of stroke, mortality
Benzodiazepines	All classes	Avoid unless seizure disorder, alcohol withdrawal	Sensitivity to benzodiazepines increasing cognitive impairment, delirium, falls
Insulin sliding scale		Avoid	High risk of hypoglycemia
Megestrol		Avoid	Minimal effect on weight Thrombosis
Sulfonylureas	Chlorpropamide Glyburide	Avoid	Prolonged half-life leading to prolonged hypoglycemia
Gastrointestinal	Metoclopramide	Avoid	Extrapyramidal effects leading to tardive dyskinesia
Pain control	Meperidine	Avoid	Not an effective oral agent—safer alternatives present
	NSAIDs	Avoid chronic use	Increased risk of GI bleeding (proton pump inhibitor does not eliminate risk) Increased high blood pressure
Skeletal muscle relaxants	Cyclobenzaprine	Avoid	Anticholinergic

CNS = central nervous system; NSAID = nonsteroidal anti-inflammatory drug.

inappropriate in older adults,[98] which has been validated in diverse populations and linked to adverse events, including delirium, gastrointestinal bleeding, falls, and fractures (Table 4). A review of a patient's medication list is advised to prevent adverse events from these potentially inappropriate medications.

6.4. Alcohol and illicit drugs

Despite the high prevalence of alcohol abuse and dependency among older adults in the USA, anesthesiologists and care teams often miss this diagnosis.[116] Adverse effects of excessive alcohol include increased frequency of pneumonia, delirium, wound dehiscence, sepsis, and mortality.[117] Validated screening questions can assist in diagnosis. Deferring elective surgery until abstinence has been accomplished can allow the recovery of liver and bone marrow, correct nutritional deficiencies, and most importantly, prevent alcohol withdrawal syndrome. Abuse of psychoactive prescription drugs is also projected to be of increasing concern among the elderly, and contributes to delirium after drug withdrawal, drug–drug and drug–disease interactions, and tolerance effects. A single question tool, “How many times in the past year have you used an illegal drug or used a prescription medication for non-medical reasons?”, is valuable as a screening device and should be considered in all patients being evaluated.

7. Patient selection

Unfortunately, there is no information to standardize the current approach of patient selection in patients undergoing BSx. However, data from the general surgery literature can assist both medical and surgical staff in patient selection. The ideal candidate would have the characteristics summarized in Table 5. The patient should have similar criteria to younger patients. A true multidisciplinary assessment, including a preoperative behavioral management program, psychological screening, and evaluation and management of medical comorbidity, is necessary. Ensuring that candidates are treated at a center of excellence is preferable, as the majority of short-term complications are a result of the surgery itself. We would promote, if at all possible, a laparoscopic technique.

The comprehensive assessment should focus on psychosocial and functional status. An excellent support system of family, friends, or caregiver resources is imperative. Cognitively intact patients with some impairment in basic or instrumental ADL need not be excluded; however, a life expectancy of >10 years, in our opinion, would better assure an ideal risk/benefit ratio. Older people with frailty are at a high risk for medical and surgical complications and risk of death. Preoperative delirium protocols are necessary. The selected patient should be capable of engaging in physical interventions focusing on mitigating sarcopenia and osteoporosis; maintaining changes in eating behavior is needed as well. A recommended prehabilitation program may include a physical therapist to assist with strength and endurance training and a nutritionist to aide in enhancing protein intake vitamin D and other nutrient sufficiency. Certain centers have formal prehabilitation programs,[118] but there is no formal evidence to suggest its benefit in BSx.

Identifying goals of care, quality of life, and improved function should be considered as primary objectives of undergoing surgery. Goals of the surgery include not only weight loss, but also

Table 5
Proposed selection criteria for the ideal older candidate for bariatric surgery.

Criteria	Characteristic	Details
Objective Measurements	Body mass index	>35 kg/m^2
	Expected life expectancy	>10 y
	Grip strength	<30 kg in men and <20 kg in women, measured using a dynamometer, suggest weakness
	Gait speed	>1 m/s
Subjective measurements	Current quality of life	Poor
	Fried frailty criteria	≥3 components place patients at high risk of institutionalization/readmission
Surgical	Type of bariatric surgery	Roux-en-Y
	Surgical approach	Candidate for laparoscopy
Medical comorbidity	Respiratory	Good respiratory function (no significant COPD)
		Controlled sleep apnea
	Renal function	Estimated GFR ≥30 mL/min
	Urologic	No significant signs/symptoms of prostatism
	Medication reconciliation	Elimination of high-risk medications[98]
Neuropsychiatric	Depression	Controlled with nonpharmacological & pharmacological therapies
		Psychotherapy
	Cognition	MMSE or SLUMS ≥24/30
		MOCA ≥26
		Callahan screening test <3
Social support	Caregiver support	Not living alone—supportive family/caregiver
	Home setup	Bedroom/bathroom on the same level
		Minimal usage of stairs
Previous surgical course	Delirium	Previous history of delirium increases risk of future delirium
	Past surgeries	Functional decline following past surgery predicts future functional decline
Geriatric assessment	Function	Full basic/instrumental ADL assessment; whether function is affected by conditions that will not improve after surgery
	Vision	No significant visual impairment—checked regularly by an optometrist
	Hearing	Amplification if necessary
	Fall screener	Assessed by Timed Get up and Go
		Identifying reasons for falling
Other	Drugs of abuse	Screening with simple questions
	Advanced care planning	Advanced directive, durable power of attorney for health care on file

ADL = activities of daily living; GFR = glomerular filtration rate; MMSE = Mini-mental status examination; MOCA = Montreal Objective Cognitive Assessment; SLUMS = St. Louis University Mental Status examination; COPD = Chronic Obstructive Pulmonary Disease.

improvements in physiological function, comorbidity, and quality of life, and reduction in institutionalization. Involvement of geriatric specialists in preoperative medical and psychosocial care is of utmost importance for the issues outlined above. There is ample evidence in the literature recognizing the comanagement role of geriatric consultation in the inpatient setting, particularly among hip fracture patients.[119] While existing studies focus on short-term metabolic and mortality outcomes, little is known yet on long-term outcomes in older patients. Future research is needed to better characterize these important outcomes.

8. Conclusion

Owing to the "graying" of the population and worsening obesity epidemic, and with an increasing availability of surgeons and the improvement of surgical techniques, more BSx will likely be performed on geriatric patients. The medical consultant is charged with confirming that surgery represents the consequence of the patient's informed decision, and should identify patient- and procedure-related factors affecting surgical morbidity, mortality, and long-term outcome. Surgery-specific risks should be weighed against potential obesity-related disability that the patient is likely to incur. We recommend that age should not be the sole determinant in older adults seeking BSx, but that a comprehensive geriatric assessment, utilizing objective measures, be incorporated to ascertain whether the older patient is a suitable candidate for BSx.

Conflicts of interest

The authors declare no conflicts of interest.

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